Omiltemia Standley, gen. nov.

Branched shrubs, more or less pubescent, the branchlets angulate. Leaves opposite and ternate, petiolate, membranaceous. Stipules minute, deciduous. Flowers of medium size, red, axillary, solitary, long-pedicellate, the pedicels bibracteolate at the base; calyx tube narrowly turbinate, the limb 4-lobate, the lobes linear-subulate, subequal, persistent; corolla tubular, glabrous, the tube elongate, slender and constricted near the base, ampliate in the upper three-fourths, the limb 4-lobate, the lobes short, oblong-ovate, subulate-acuminate, erect or ascending, contorted. Stamens 4, inserted at the base of the ampliate portion of the corolla tube; filaments filiform, exserted; anthers linear, dorsifixed, mucronate, bifid at the base. Disk depressed. Ovary 2-celled; style filiform, exserted, glabrous; stigma fusiform; ovules numerous, imbricate, the placentae oblong, peltately affixed to the septum. Capsule 2-celled, cylindric, elongate, subcoriaceous, costate, loculicidally bivalvate at the apex. Seeds numerous, minute, subglobose, obtusely angulate, the testa lustrous, reticulate; endosperm fleshy.

Type species, *Omiltemia longipes* Standley.

Omiltemia longipes Standley, sp. nov.

Shrub, about 3 meters high, the branches stout, grayish, terete, the branchlets slender, puberulent when young, densely leafy; stipules deltoid, about 1 mm. long; leaves mostly ternate, the petioles slender, 2–6 mm. long, puberulent, often marginate to the base, the blades oblanceolate or oblanceolate-oblong, 3–7 cm. long, 0.8–1.7 cm. wide, acuminate or long-attenuate at the base, acute to long-attenuate at the apex, often abruptly so, thin, bright-green, concolorous, glabrous above or puberulent along the costa, the venation plane, villosulous beneath along the veins or glabrate, inconspicuously striolate, the costa slender, prominent, the lateral veins prominulous, 4–6 on each side, arcuate; pedicels 1.7–3.5 cm. long, filiform, sparsely short-pilose, the bractlets minute, linear, green; calyx very sparsely short-pilose or glabrate, the tube 6–7 mm. long, the lobes 3–4 mm. long; corolla red, about 4 cm. long, the contracted portion of the tube about 1 cm. long and 1.2 mm. thick, the upper portion 5–6 mm. thick, the lobes about 5 mm. long; anthers 7 mm. long, the filaments about 2.5 cm. long; style about 4.5 cm. long; capsule 1.4 cm. long, 2.5–3 mm. thick; seeds brown.

Type in the U. S. National Herbarium, no. 399394, collected at Omilteme, Guerrero, May, 1903, *E. W. Nelson 7054*.

ZOOLOGY.—*Opalina and the origin of the ciliate Infusoria.*[1]

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Study of a large amount of material from the United States National Museum collections of frogs and toads shows several

[1] Abridged from a paper read before the Biological Society of Washington, May 4, 1918.

dozen new species of Opalinidae and necessitates revision of the taxonomy in the family and in the Ciliata. The new forms enable us to gain a comprehensve knowledge of the plan of speciation among the Opalinidae and the conditions revealed in this family throw light upon the origin of the Ciliata.

The family Opalinidae comprises properly but two genera—*Protoopalina* (new genus) and *Opalina*. *Protoopalina* has one nucleus or in most species two nuclei. Their nuclei contain two distinct sets of large, flat, superficial chromosomes of constant and characteristic number in each species, and another more central set composed of the same number (in the species thus far studied) of slender chromosomes each consisting of a linear aggregate of granules much as in *Paramecium*, except that the granules are much coarser in these large nuclei. In mitosis the daughter nuclei each receive one-half of each chromosome of each sort (massive and granular).

Opalina has many nuclei (4 to several thousand). Each nucleus contains some (not many) large, flat, superficial chromatin masses of varying number in the different nuclei in the body and also numerous, more central, slender chromosomes, each a linear aggregate of granules. It is probable that these linear chromosomes are of constant number for each species, but they are too numerous for easy study. In the genus *Opalina* the granular chromosomes seem to be as carefully and regularly divided as they are in *Protoopalina*, but the larger masses of chromatin are irregularly divided in mitosis, and some of them may occasionally remain undivided, passing bodily without division into one of the daughter nuclei.

In both *Opalina* and *Protoopalina* the massive chromosomes are trophic, the granular chromosomes reproductive. Each nucleus contains both kinds of chromatin and there is no specialization, as in the higher Ciliata, of whole nuclei as trophic and other whole nuclei as reproductive.

The most characteristic feature of the higher Ciliata is the possession by each individual of a large trophic nucleus and another minute reproductive nucleus. The absence of this character in the Opalinidae justifies placing them as an archaic group, Protociliata, and classing the rest of the Ciliata as Euciliata..

The archaic features of the Protociliata are: (1) the transient character of their pleurinucleate condition, the gametes in the spring becoming uninucleate; (2) the consequent absence of differentiation of whole nuclei for trophic function (macronuclei) and of other whole nuclei for reproduction (micronuclei), each nucleus instead containing chromatin of both sorts; (3) the very primitive nature of the contractile vacuole—merely a temporary fusion of some of the axial alveoles to form an irregular and usually branched tubule opening by a posterior pore; (4) binary fission both longitudinal and transverse; (5) sexual union, the complete fusion of very dissimilar gametes. A secondary feature is the complete absence of a buccal groove. Numerous genera of Euciliata also show this secondary modification—e.g., *Hoplitophrya*, *Anoplophrya*, *Discophrya*, *Chromidina*, etc. In both Protociliata and Euciliata this feature is doubtless due to parasitism.

The author described mitosis in a species of *Protoopalina* (Opalina), discovered by Professor J. H. Powers, whose two nuclei are found resting in a midmitotic condition (anakhase). Awerinzew described an African species whose usually single nucleus rests in a similar midmitotic stage, and because of its uninucleate character named the species *Opalina* [*Protoopalina*] *primordialis*. In the National Musem material is a still more archaic species (as yet unnamed) from *Bufo regularis* whose single nucleus is in an earlier phase of mitosis than is that of *Protoopalina primordialis*. Starting with this unnamed species we may arrange the Opalinidae according to their nuclear condition: first a species with a single nucleus resting in a mitotic condition but little past the critical (mitotic) phase; then *Protoopalina primordialis* with nucleus in an anaphase condition; then several species with each a single nucleus in a late anaphase or a telophase condition; then numerous species each with two distinct resting nuclei; then several species each with two nuclei each of which is just entering upon mitosis; then two or more species each with two nuclei both being in about the critical phase of mitosis; then numerous species each with two nuclei both in an anaphase of mitosis; others with two nuclei each in a

telophase of mitosis. All species thus far mentioned in this paragraph are Protoopalinae with characteristic protoopalinid nuclei. Simplest in the genus *Opalina* is *O. lanceolata* (of Bezzenberger) with four nuclei; then *O. mimuta* (new species from *Bufo melanostictus*) with from five to twelve nuclei; then very many species with from one hundred to several thousand nuclei.

It seems evident that the pleurinucleate condition in the Opalinidae is due to some disturbance of the mitotic phenomena and the usual nucleus-cytoplasm relation, nuclear mitosis and body division being inhibited to a less or greater degree in different species. As this strange tendency develops we get finally bodies with a great number of nuclei. Among the Opalinids the culmination of this disturbance of the division phenomena is seen in the new species, *Opalina segmentata,* in which species even the vegetative fissions, which occur from time to time in both multinucleate and binucleate species, are inhibited after they have begun. *Opalina segmentata* is an elongated cylindrical species (snake-shaped) with thousands of nuclei. Numerous fissions which have started at different levels in the body are still incomplete, giving the whole animal a metamerized appearance. Of course this is but pseudo-metamerization for it is not due to apical budding but rather to interrupted transverse fissions which have started at different points along the elongated body.

The Opalinidae are an offshoot from the ancestral Ciliata at a time when mitotic phenomena and the nucleus-cytoplasm relation were becoming disturbed. They have some of them remained in an early stage of this condition. Others have developed the tendency further and have become highly multinucleate. The Euciliata, rising doubtless from such pseudobinucleate forms as the Protoopalinae, have passed on to a permanently binucleate condition, even their gametis being binucleate, when properly analyzed. The permanence of their binuclearity, once established, allowed the differation of one whole nucleus for nutrition (macronucleus) and of the other whole nucleus for reproduction (micronucleus). The Opalinidae as a whole are a group in which the condition of nucleus and cytoplasm as to mitosis

are still in flux. The Euciliata, advancing from this condition, have become stereotyped in a definitely binucleate state with secondary nuclear specialization.

Classification of Ciliata

Protociliata
  Opalinidae
    Protoopalina
    Opalina
Euciliata

ZOOLOGY.—*Synopsis of the supergeneric groups of Rodents.*[1] GERRIT S. MILLER, JR., and JAMES W. GIDLEY, U. S. National Museum.

Work on the taxonomy of the Rodents, living and extinct, has occupied much of our time during the past four years. This paper contains a brief synopsis of the results.

The classification which we have adopted is based on the following conception of the evolutionary course followed by the order during its development. This course has been mainly conditioned by the mechanical problem of strengthening a chewing apparatus in which the unusually important cutting function of the incisors is strongly contrasted with the grinding function of the cheekteeth; the highest degree of efficiency to be given always to the incisors and in most instances to the cheekteeth as well. The problem has been solved by five sequences of correlated changes in the masseter muscle and the bones to which this muscle is attached. All of these sequences could originate from the structures present in a generalized mammal, but there is no evidence that any rodent during its development has passed from one to another. The groups characterized by the various sequences are therefore natural. We have treated them as superfamilies: the *Sciuroidae*, *Myoidae*, *Dipodoidae*, *Bathyergoidae*, and *Hystricoidae*. Of the secondary problems the most conspicuous has been the strengthening of the cheekteeth. These teeth, however unlike their structure in extreme instances may appear, have all been developed from some primitive, low-crowned, tritubercular type not essentially different

[1] Published by permission of the Secretary of the Smithsonian Institution.